CLAIMS

1. A polymer electrolyte composite membrane comprising a porous base material having fine pores which is fill with a polymer electrolyte comprising a hydrophobic moiety and a hydrophilic moiety,

wherein each phase of the hydrophobic and a hydrophilic moieties of the polymer electrolyte satisfy the following formula (1)

$a+b \leqq d$ (1)

(wherein a represents the size (nm) of a hydrophobic domain, b represents the size (nm)of a hydrophilic domain, and d represents the average pore diameter (nm) of fine pores of the porous base material).

2. The polymer electrolyte composite membrane according to claim 1, wherein the formula (1) is $a+b \leqq d/2$.

3. The polymer electrolyte composite membrane according to claim 1, wherein a value of a+b is equal to or more than 3 nanometers.

4. The polymer electrolyte composite membrane according to claim 1, wherein a value of a+b is equal to or more than 10 nanometers.

5. The polymer electrolyte composite membrane according to claim

1 or 3, wherein a value of a+b is equal to or less than 200 nanometers.

6. The polymer electrolyte composite membrane according to claim 1 or 4, wherein a value of a+b is equal to or less than 100 nanometers.

7. The polymer electrolyte composite membrane according to claim 7, wherein a hydrophilic repeating unit has an ion-exchange group.

8. The polymer electrolyte composite membrane according to claim 8, wherein an ion-exchange group is cation-exchange group or anion-exchange group.

9. The polymer electrolyte composite membrane according to claim 9, wherein a cation-exchange group is at least one selected from a group consisting of $-SO_3H$, -COOH, $-PO(OH)_2$, -POH(OH), -Ph(OH) (Ph represents a phenyl group).

10. The polymer electrolyte composite membrane according to claim 9, wherein an anion-exchange group is at least one selected from a group consisting of $-NH_2$, -NHR, -NRR', $-NRR'R''^{+}$ $-NH_3^{+}$(R represents an alkyl group, cycloalkyl group, aryl group, etc.).

11. A polymer electrolyte composite membrane having a continuous phase-separated structure in which a hydrophobic moiety and a

hydrophilic moiety of polymer electrolyte are parallel to a membrane thickness direction.

12. Method for manufacturing a polymer electrolyte membrane by compositing a porous base material and a polymer electrolyte comprising a hydrophobic moiety and a hydrophilic moiety, and each phase of the hydrophobic and the hydrophilic moieties of the polymer electrolyte satisfy the following formula (1)

$$a+b \leqq d \quad (1)$$

(wherein a represents the size (nanometer) of a hydrophobic domain, b represents the size (nanometer)of a hydrophilic domain, and d represents the average pore diameter (nanometer) of fine pores of the porous base material).

13. The method for manufacturing a polymer electrolyte membrane according to claim 13, wherein the method comprising of dissolving a polymer electrolyte in solvent, impregnating a porous base material with the solution, taking out the porous base material, drying solvent, and then compositing the porous base material and the polymer electrolyte.

14. The method for manufacturing a polymer electrolyte membrane according to claim 13, wherein the method comprising of dissolving a polymer electrolyte in solvent, applying the solution on a porous base material, drying solvent, and then compositing the porous base

material and the polymer electrolyte.

15. The method for manufacturing a polymer electrolyte membrane according to claim 13, wherein the method comprising of dissolving a polymer electrolyte in solvent, contacting a porous base material with the solution under reduced pressure, then returning the pressure to a normal pressure, drying solvent, and then compositing the porous base material and the polymer electrolyte.

16. A fuel cell comprising the polymer electrolyte composite membrane according to claim 1.